REMARKS

Claims 1-48 and 50-95 are presented for consideration by the Examiner. Claims 27, 32, 39, 41, 73, and 83 have been amended, and new claims 94 and 95 are presented in response to the rejections and remarks in the Office Action mailed January 31, 2005, and every ground of rejection has been addressed.

I. EXAMINER INTERVIEW WAS HELD

A telephone interview was held with the Examiner on June 24, 2005, during which agreement was reached on some of the issues raised by applicant. The Examiner's remarks were helpful in assisting applicant's counsel in focusing on elements the Examiner considers most promising. A report of the substance of the interview is contained in the remarks below.

The amendments above were made in accordance with the discussion in the Examiner Interview, and applicant makes the following points of law and fact in further support of allowance of the claims. The amendments are made without prejudice to any future submission of the original claims in a subsequent application.

II. AMENDMENTS TO THE SPECIFICATION

Minor amendments to the specification have been made herein to correct reference numerals and improve the clarity of the

disclosure. The changes made to the specification are supported in, and consistent with, the remainder of the disclosure. No new matter has been added.

III. AMENDMENTS TO DRAWINGS

A replacement sheet for FIG. 3 is provided herewith to correctly depict reference numerals 226 and 228. The corrected FIG. 3 is labeled "Replacement Sheet" in accordance with 37 C.F.R. § 1.121 and M.P.E.P. § 608.02(p). In order to more clearly indicate the changes being made to the drawings, a marked-up copy labeled "Annotated Marked-Up Drawing" is also included herewith in accordance with 37 C.F.R. § 1.121 and M.P.E.P. § 608.02(p).

IV. REJECTION OF CLAIMS UNDER 35 U.S.C. § 112 ARE TREATED

Regarding the rejection of claims 87-92 under 35 U.S.C. § 112, first paragraph, Applicant respectfully traverses the rejection. The specification on page 44 line 1 to page 45, line 6, as well as the equations R7 to R9 on lines 10-12 of page 43 comply with the enablement requirement of 35 U.S.C. § 112, first paragraph. As to the assertion in the Office Action that U.S. Patent No. 4,420,332 to Mori et al. teaches that no hydrogen would be formed, Applicant points out that conditions such as temperature and pressure, or other reagents used in the Mori et

al. reference, may provide for different reactions to occur, such that Applicant is not required to explain why other situations may provide different results. Moreover, equations R7 and R8 of the present disclosure also indicate that water and carbon dioxide may be formed, consistent with the teachings in the Mori et al. patent, but equation R9 of the present disclosure demonstrates that hydrogen may also be formed ($3Fe + 4H_2O$ ----> $Fe_3O_4 + 4H_2$). Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. § 112, first paragraph be withdrawn.

V. REJECTIONS OF CLAIMS UNDER 35 U.S.C. §§ 102 AND 103 ARE TREATED

Claims 1-93 were rejected as being anticipated by, or obvious under, one or more of the following patents: U.S. Patent No. 4,560,547 to Schora et al. (hereinafter "Schora"), U.S. Patent No. 5,980,858 to Fujimura et al. (hereinafter "Fujimura), and U.S. Patent No. 4,420,332 to Mori et al. (hereinafter "Mori).

Regarding claim 1, claim 1 requires steps a-d as depicted in FIG. 1, including transporting oxygen and a first source of carbon monoxide into a combustion chamber (see element 12). Claim 1 also requires in step e, transporting carbon monoxide produced in said combustion chamber to a hydrogen production combustion chamber and combusting said carbon monoxide with oil shale to produce hydrogen, as shown in FIG. 2, element 112.

Accordingly, claim 1 requires use of two combustion chambers, one for producing carbon monoxide, and one for combusting oil shale to produce hydrogen. Neither the Schora nor the Fujimura references disclose a method for producing hydrogen that uses two combustion chambers as required by claim 1.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegall Bros. V. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Since the Schora, the Fujimura and the other references of record do not disclose use of two combustion chambers in combination with the other features as required by claim 1, as agreed by the Examiner in the Examiner interview, these references do not anticipate claim 1. Moreover, to establish *prima facie* obviousness of a claimed invention, <u>all</u> the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). There is no suggestion or motivation to modify the prior art of record to provide all of the subject matter of claim 1. Accordingly, claim 1 is believed to be allowable.

Dependant claims 2-26 depend from claim 1 or a claim depending from claim 1, and are therefore believed to be allowable for at least the reasons given in support of claim 1.

Regarding claim 27, subject matter has been added to the claim to require combusting a carbon monoxide by-product with hydrocarbons, oxygen and steam in "a hydrogen producing combustion chamber" to produce hydrogen. This subject matter is supported in the disclosure, *inter alia*, claim 1 and page 28, lines 8-10, and is therefore not new matter. Accordingly, similar to claim 1, claim 27 also requires use of a combustion chamber and a hydrogen producing combustion chamber, in combination with other features of the claim. Since the Schora and Fujimura patents, and the other references of record, do not disclose or suggest all of the subject matter now required by claim 27, claim 27 is believed to be allowable.

Dependant claims 28-31 depend from claim 27 or a claim depending from claim 27, and are therefore believed to be allowable for at least the reasons given in support of claim 27.

Regarding claim 32, the subject matter of claim 49 has been incorporated into claim 32, such that claim 32 requires passing the carbon source countercurrent to a flow of gas in the reaction chamber. By passing the carbon source countercurrent to the flow of gas in the reaction chamber, a temperature range may be accomplished in the reaction chamber which allows the reactions in the reaction chamber to be completed, thereby making the reactions more efficient. In contrast, both the Schora and the Fujimura patents disclose reaction chambers with fluidized beds

in which the carbon source flows in the same direction as the gas in the reaction chambers, which is opposite that required by claim 32. As agreed by the Examiner in the Examiner interview, the Schora and the Fujimura patents do not disclose all of the subject matter now required by claim 32. Moreover, there is no suggestion or motivation to modify the prior art of record to provide all of the subject matter of claim 32. Accordingly, claim 32 is believed to be allowable.

Dependant claims 33-40, 42-48 and 50-60 depend from claim 32 or a claim depending from claim 32, and are therefore believed to be allowable for at least the reasons given in support of claim 32.

Claim 41 has been re-written in independent form including the subject matter of claims 32, 38 and 39. Accordingly, claim 41 requires subject matter including: providing a first zone, a second zone and a third zone in said reaction chamber, directing a flow of gas in said reaction chamber from said first zone to said second zone to said third zone, and circulating said gas from said third zone to said second zone through a first gas re-circulation line. As agreed by the Examiner in the Examiner Interview, the Schora and the Fujimura patents do not disclose all the subject matter of claim 41. Moreover, there is no motivation in the prior art to combine all of the subject matter

required by claim 41. Accordingly, claim 41 is believed to be allowable.

Regarding claim 61, use of a combustion chamber is required in which three zones are defined, a first zone, second zone, and a third zone. A flow of gas is directed from the first zone to the second zone to the third zone, whereas a carbon source is placed in the third zone and moves from the third zone to the second zone to the first zone. As discussed above with regard to claim 32, and as agreed by the Examiner in the Examiner interview, both the Schora and the Fujimura patents disclose movement of the gas and the carbon source in the same direction. Accordingly, the reaction chambers in the Schora and Fujimura patents could not be arranged to meet the limitations of claim 61. Since the prior art references of record do not teach or suggest all of the subject matter required by claim 61, claim 61 is believed to be allowable.

Dependant claims 62-72 depend from claim 61 or a claim depending from claim 61, and are therefore believed to be allowable for at least the reasons given in support of claim 61.

Regarding claim 73, subject matter has been added to the claim including "wherein a temperature of said combustion chamber decreases from said first zone to said second zone to said third zone." This subject matter is supported in the disclosure, *inter alia*, on page 30, lines 1-16, and is therefore not new matter.

The temperature range in the combustion chamber allows the required reactions to go to completion efficiently. It will also be understood that claim 73 requires placing said carbon source in the third zone of the combustion chamber and directing movement of the carbon source from the third zone to the second zone to the first zone; and directing an effluent of hydrogen and carbon monoxide out of said combustion chamber at a location between said second zone and said third zone. Accordingly, as agreed by the Examiner in the Examiner Interview, a combination of features is required in claim 73 which is not disclosed by the Schora patent, nor could the combustion chamber disclosed in the Schora patent be arranged in such a manner so as to include all of the required features of the zones as required by claim 73. Moreover, there is no motivation or suggestion in the prior art to arrive at all of the features of claim 73. Accordingly, claim 73 is believed to be allowable.

Claim 74 depends from claim 73 and is therefore believed to be allowable for at least the reasons given in support of claim 74.

Regarding claim 75, claim 75 requires providing temperatures in the third zone ranging between approximately 300 degrees F to approximately 800 degrees F. The Schora patent discloses temperatures ranging from about 1200 degrees F, to about 2000 degrees F. Accordingly, as agreed by the Examiner in the

Examiner Interview, the temperatures required in the third zone of claim 75 are outside the range disclosed by the Schora patent. Moreover, claim 75 requires other steps, including placing the carbon source in the third zone of the combustion chamber. Thus, claim 75 requires a combination of features that are not disclosed or suggested by the Schora patent or the other prior art references of record. Claim 75 is therefore believed to be allowable.

Dependant claim 76 depends from claim 75, and claim 77 depends from claim 76, such that claims 76 and 77 are therefore believed to be allowable for at least the reasons given in support of claim 75.

Claim 78 requires recirculating a flow of gas from the third zone to the second zone through a first gas re-circulation line; and recirculating a flow of gas from the second zone to the first zone through a second gas re-circulation line. As agreed by the Examiner in the Examiner interview, this subject matter in combination with the other features of claim 78 defines a combination of features that are not taught or suggested by the Schora patent and the other prior art references of record. Accordingly, claim 78 is believed to be allowable.

Dependant claims 79-82 depend from claim 78 or a claim depending from claim 78, and are therefore believed to be allowable for at least the reasons given in support of claim 78.

Regarding claim 83, subject matter has been added including passing an effluent of hydrogen and carbon monoxide through a catalytic converter "without cooling said effluent." This subject matter is supported in the disclosure, *inter alia*, in FIG. 2, and page 36, lines 9-16, and is therefore not new matter. The Schora patent discloses passing the product gas through a waste heat boiler 42 and a cooler condenser 44 prior to the purification means 51, as shown in FIG. 1. Similarly, the Fujimura patent discloses passing the effluent gas through a heat exchanger 38 prior to entering the carbon monoxide converter 36, as shown in FIG. 4. Accordingly, as agreed by the Examiner in the Examiner Interview, the Schora and Fujimura patents fail to disclose all of the subject matter required by claim 83. Moreover, there is no motivation disclosed in the prior art references to combine all of the subject matter now required by claim 83. Accordingly, claim 83 is believed to be allowable.

Dependant claims 84-86 depend from claim 83 or a claim depending from claim 83, and are therefore believed to be allowable for at least the reasons given in support of claim 83.

Regarding claim 87, the step of percolating the effluent of hydrogen and carbon monoxide through fluidized beds of magnetite in a ferrous deoxidizer to produce hydrogen, is required. The chemical equations describing the reactions that take place in

this step are described on page 44 line 1 to page 45, line 6, and equations R7 to R9 on page 43 as follows:

(R7) $Fe_3O_4 + 4H_2 \text{ ----> } 3Fe + 4H_2O$;

(R8) $Fe_3O_4 + 4CO \text{ ----> } 3Fe + 4CO_2$;

(R9) $3Fe + 4H_2O \text{ ----> } Fe_3O_4 + 4H_2$.

The Office Action relies on the Mori reference in combination with either the Schora or Fujimura references to reject claim 87. However, as agreed by the Examiner in the Examiner Interview and as shown in the equations on column 7, lines 7-16, the Mori patent does not disclose a method of producing hydrogen. Accordingly, not all of the subject matter required by claim 87 is disclosed in the combination of references cited. Moreover, there is no motivation to combine the Mori reference with the Schora patent or the Fujimura patent. A rejection for obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ 2d 1596 (Fed. Cir. 1988). Since the prior art references of record do not disclose or suggest all of the subject matter required by claim 87, claim 87 is believed to be allowable.

Dependant claims 88-92 depend from claim 87 or a claim depending from claim 87, and are therefore believed to be allowable for at least the reasons given in support of claim 87.

Regarding claim 93, various features are required that are not disclosed or suggested in the prior art of record. For example, claim 93 requires features discussed above including:

wherein the method further comprises directing a flow of gas in said reaction chamber from said first zone to said second zone to said third zone;

wherein the method further comprises directing movement of the oil shale from the third zone to the second zone to the first zone;

wherein the method further comprises circulating said gas from said third zone to said second zone through a first gas re-circulation line;

wherein the method further comprises circulating said gas from said second zone to said first zone through a second gas re-circulation line;

wherein the method further comprises directing said effluent of hydrogen and carbon monoxide out of said reaction chamber at a location between said second zone and said third zone;

wherein the method further comprises passing the oil shale countercurrent to a flow of gas in the reaction chamber;

wherein the method further comprises controlling the temperature in the first zone to range between approximately 1100 degrees F to approximately 1800 degrees F;

wherein the method further comprises controlling the temperature in the second zone to range between approximately 800 degrees F to approximately 1100 degrees F;

wherein the method further comprises controlling the temperature in the third zone to range between approximately 300 degrees F to approximately 800 degrees F.

This combination of features is not disclosed or suggested by the prior art references of record, and claim 93 is therefore believed to be allowable.

Regarding new claim 94, the subject matter of original claim 32 is required plus the step of recirculating the flow of gas in said reaction chamber along a re-circulation path that is external to the reaction chamber and that does not encounter a cooling device. This subject matter is supported in the disclosure, *inter alia*, in FIG. 2 through gas re-circulation lines 140 or 144, and is therefore not new matter. As agreed by the Examiner in the Examiner Interview, neither the Schora patent nor the Fujimura patent disclose such a re-circulation path without cooling. Moreover, there is no motivation or suggestion disclosed in the prior art to arrive at the subject matter of claim 94. Accordingly, claim 94 is believed to be allowable.

Regarding claim 95, all the subject matter of original claim 32 is required as well as the step of withdrawing a second gas effluent from said reaction chamber for recirculating into said reaction chamber. This subject matter is supported in the disclosure, *inter alia*, in FIG. 2 through gas re-circulation lines 140 or 144, and is therefore not new matter. As agreed by the Examiner in the Examiner Interview, neither the Schora patent nor the Fujimura patent disclose such a second gas effluent from said reaction chamber for recirculating into said reaction chamber. Moreover, there is no motivation or suggestion disclosed in the prior art to arrive at the subject matter of claim 95. Accordingly, claim 95 is believed to be allowable.

VI. SEPARATE PATENTABILITY OF DEPENDENT CLAIMS EXPLAINED

Several dependant claims are also believed to be allowable on their own merits and independent of the allowability of their base claims, as explained in more detail below.

For example, claim 4 requires passing the oil shale countercurrent to the flow of gas in the hydrogen producing combustion chamber. None of the prior art of record provides any supporting teaching or suggestion of such an element, and claim 4 is therefore believed to be independently allowable on that basis, regardless of whether its base claim is allowable.

Claims 21, 31, 37, and 55 require percolating the gas through multiple fluidized beds of magnetite. As discussed above, none of the prior art of record provides any supporting teaching or suggestion of such an step, and claims 21, 31, 37, and 55 are therefore believed to be independently allowable on that basis, regardless of whether their base claims are allowable.

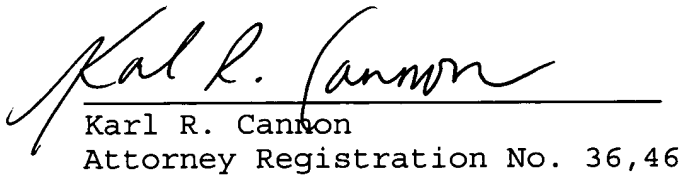
VII. CONCLUSION AND AUTHORIZATION OF DEPOSIT ACCOUNT

In view of the foregoing, applicant believes that claims 1-48 and 50-95 are all allowable and the same is respectfully requested. If any impediment to the allowance of these claims remains after entry of this Amendment, and such impediment could be alleviated during a telephone interview, the Examiner is invited to initiate the same.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 50-0836.

DATED this 30 day of June, 2005.

Respectfully submitted,



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Annotated Marked-up Drawing

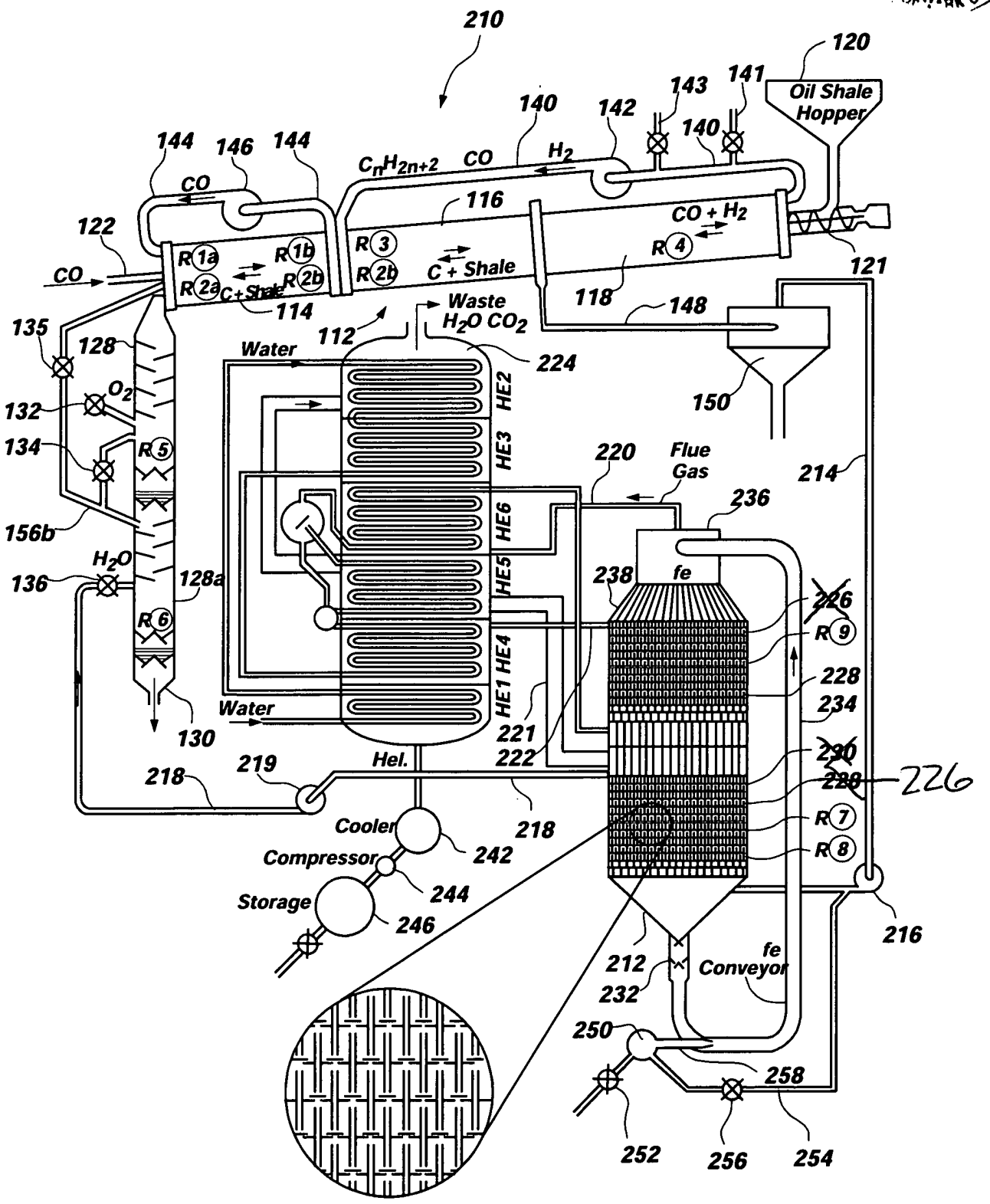

FIG. 3